

## HOWELLANTHUS DALESIANUS, RECOGNITION OF A NEW GENUS AND SPECIES IN TRIBE PHACELIEAE (BORAGINACEAE)

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### ABSTRACT

**Howellanthus** (Constance) Walden and R. Patt. is recognized as a new genus, containing a single species **H. dalesianus** (J. T. Howell) Walden and R. Patt., based on morphological evidence. **Howellanthus dalesianus** (Boraginaceae) is a small perennial herb, endemic to northern California and restricted to ultramafic soils. The species was first collected in 1936 by Ella Dales Cantelow and Herbert Clair Cantelow, described by John Thomas Howell as *Phacelia dalesiana* J. T. Howell, and later placed in the monotypic *Phacelia* subg. *Howellanthus* by Lincoln Constance.

Key Words: Boraginaceae, *Howellanthus*, Hydrophyllaceae, Hydrophyllloideae, *Phacelia*, Phacelieae, serpentine.

*Phacelia dalesiana* J. T. Howell was first described in 1937, and named in honor of Ella Dales Miles Cantelow, a long-time friend and correspondent of John Thomas Howell (Campbell n.d.; Howell 1954–1955, 1955, 1955–1957). Ella Dales Cantelow, with her husband, Herbert Clair Cantelow, collected specimens on a trip to the Scott Mountains (Siskiyou Co., California) in 1936. A duplicate was sent to Howell at the California Academy of Sciences for identification, and the “remarkable new phacelia” piqued his interest sufficiently to request an expedition to collect mature fruiting material (Fig. 1) (Cantelow 1937–1940; Howell 1937). The following year Howell and Alice Eastwood traveled to Scott Mountain, guided by the Cantelows, to collect the type specimen. Howell returned again to Scott Mountain in July to collect additional material with mature fruit for the description, and published the new taxon (Howell 1937).

Constance (1953) erected the monotypic subg. *Howellanthus* ( $n = 8$ ) to contain the distinct species (see Constance 1953, p. 201 for scientific illustration), based upon chromosome number differences and taxonomic revisions of infrageneric divisions in *Phacelia* (Cave and Constance 1942, 1944, 1947, 1950; Constance 1949, 1950, 1951). The subgenus has since remained monotypic in treatments of the genus, separated from subg. *Phacelia* ( $n = 11$ ) and subg. *Cosmanthus* ( $n = 9$ ) (Constance 1963; Constance and Chuang 1982; Halse et al. 1993; Ferguson 1998; Garrison 2007).

*Phacelia dalesiana* has been considered a paleoendemic due to several factors: the systematic isolation of the taxon within *Phacelia*; a hypothesized relictual lineage within Hydrophyll-

loideae; and the ecologic specialization on ultramafic substrate, although it lacks the high ploidy level characterizing other paleoendemics (Constance 1953; Favarger and Contandriopoulos 1961; Stebbins and Major 1965). It occurs in the Siskiyou–Trinity mountains, an area of high concentration of Arcto–Tertiary relictual species (Stebbins and Major 1965).

The strongest argument to retain the taxon within *Phacelia* has been common, shared characters between species across several infrageneric divisions in the genus: the scorpioid cyme, although few flowered, lax and axillary from a basal rosette in *P. dalesiana* (Figs. 2 and 3); presence of interstaminal corolla scales (Fig. 4), modified in subg. *Cosmanthus* or absent in sect. *Whitlavia* and sect. *Gymnobythus*; deeply parted style, which can be lobed in some species of the genus; entire leaves and perennial habit; and  $n = 8$ , shared with *P. stebbinsii* Constance and Heckard, *P. marcescens* Eastw. ex J. F. Macbr., *P. glabra* Nutt., and *P. quickii* J. T. Howell. However, these characters are also shared to varying degree with *Draperia* Torr., *Hesperochiron* S. Watson, *Romanzoffia* Cham., and *Tricardia* Torr. ex S. Watson (Table 1), which left *P. dalesiana* in an uncertain and isolated relationship with these genera and *Phacelia* (Walden 2010).

The species is easily recognized morphologically as a member of subfamily Hydrophyllloideae, but is distinct from other members of tribe Phacelieae and warrants recognition as a separate genus from *Phacelia*. The taxon can be distinguished from *Phacelia* by the combination of perennial, acalcescent habit, axillary few-flowered scorpioid inflorescence, presence of multicellular glandular trichomes with unicellular ellipsoidal heads, deeply parted style, paired pendant ovules, semiorbicular corolla scales,  $n = 8$ , and tricolpo-

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FIG. 1. Herbert Clair Cantelow, John Thomas Howell and Ella Dales Miles Cantelow on porch at Scott Ranch (1936 photo by grandson Herbert Park Cantelow, courtesy of the Cantelow family and of Ella Dales and Herbert Cantelow papers, California Academy of Sciences Archives).



FIG. 2. Habit of *Howellanthus dalesianus*. Bar = 1 cm.



FIG. 3. Close up of corolla, showing semi-orbicular scales at base of filaments. Bar = 1 cm.



FIG. 4. Side view of open corolla and unexpanded bud with presence of abundant glandular trichomes. Bar = 1 cm.

rate pollen with exine striato-rugulate (Constance and Chuang 1982; Di Fulvio and Dottori 1995; Di Fulvio et al. 1999; Walden 2010).

TAXONOMIC TREATMENT

**Howellanthus** (Constance) Walden and R. Patt., gen. et stat. nov. *Phacelia* subg. *Howellanthus* Constance, Madroño 11:198–203, 1953.—Type species **Howellanthus dalesianus** (J. T. Howell) Walden and R. Patt., comb. nov., hoc loco designatus. *Phacelia dalesiana* J. T. Howell, Leaflets of Western Botany, 2:51. 1937.—Type: USA, California, Trinity Co., Summit of Scott Mountain, 25 June 1937, A. Eastwood and J.T. Howell 5014 (holotype: CAS!; isotypes CAS!, UC!, POM!).

Genus habitu *Hesperochiron*, differt cymis laxis paucifloris, vix scorpioideis; trichomata glandulifera, stipula multicellularia, capitata ellipsoidea et unicellularia; corolla alba maculis purpureis in fauce; squamae interstaminales semi-orbiculares; filamenta glabra basibus non dilatatis; stylus partitus ad basem; capsula suborbicularis, ovarium quasi divisum placentis parietalibus spissescens, ovulis 2–4, geminatis, pendulis; pollinis grana 3-colporata, striata-rugulata; semina pler-

umque 2, raro 4, alveolata; chromosomatum numerus  $n = 8$ ; species endemica terrae oriundae ex rupibus ultramaficis.

Perennial herb, 5–15 cm, densely hairy due to presence of two types of trichomes, unicellular eglandular verrucose-walled conical trichomes, and multicellular glandular trichomes with unicellular ellipsoidal heads. Basal leaves rosulate from caudex, cauline leaves alternate, sometimes appearing opposite on stems, reduced upward. Leaf blades oblong to elliptic, simple, margins entire, with lateral incised venation, 10–50 mm long, blades more or less equal to petiole. Inflorescence a lax scorpioid cyme from axils, one- to few-flowered, pedicel 10–20 mm in fruit. Sepals fused at base, lobes 5, unequal, oblanceolate, accrescent, 3–5 mm long in flower, 4–7 mm long in fruit. Corolla 5–10 mm in diameter, campanulate, fused at base, deciduous, white, sometimes fading lavender in age, throat purple-marked. Corolla scales semi-orbicular, fused to base of corolla throat but not to filaments, 2 mm long. Filaments adnate to corolla at base, glabrous, slender, included to slightly exerted, 6–8 mm long, anthers purple, pollen tricolporate, colpi nearly smooth, exine striato-rugulate. Style

TABLE 1. TAXONOMIC CHARACTERS OF *HOWELLANTHUS* AND RELATED GENERA.

Character	<i>Howellanthus</i>	<i>Phacelia</i>	<i>Draperia</i>	<i>Hesperochiron</i>	<i>Romanzoffia</i>	<i>Tricardina</i>
Inflorescence	axillary from basal lvs., barely scorpioid	scorpioid	scorpioid	axillary from basal lvs.	scorpioid	scorpioid
Flowers	one-several perennial	several-many annual, biennial or perennial	several-many perennial	solitary perennial	one-many annual or perennial	few perennial
Leaves	basal, cauline reduced, alternate	generally cauline, alternate	cauline, opposite	basal rosette	generally basal, cauline alternate	generally basal, cauline alternate
Corolla scales	present	present or absent	absent	absent	absent	present
Filaments	slender	slender	slender	broad at base	slender	slender
Style	deeply parted	to deeply parted	bifid	bifid	bifid, barely two-lobed	bifid
Seed number	2-4	1-many	1-4	many	many	4-8
Chromosome number	$n = 8$	$n = 5, 7-14, 22-24, 33$	$n = 9$	$n = 8$	$n = 11$	$n = 8$
Pollen	tricolporate	tricolpate	tricolpate	tricolpate	tricolpate	tricolpate
Capitate glandular trichomes	unicellular ellipsoid head	unicellular globose head, multicellular globose or obconic- peltate head	unicellular ellipsoidal head	unicellular cylindrical head	unicellular hemispherical head	unicellular cylindrical head

parted nearly to base, included to slightly exerted, 6-7 mm long, glabrous or sometimes pubescent-hairy at base. Ovaries one-celled, ovules paired (2-4 per ovary), pendant. Capsule 4 mm long, subspheric. Seeds 2-4, ovoid, brown, 2.5-4 mm long, surface alveolate, pubescent.  $n = 8$ . Blooming May-August.

## DISTRIBUTION

*Howellanthus dalesianus* occurs in the Scott Mountains and Trinity Alps, near the junction of Shasta, Trinity, and Siskiyou counties (Fig. 5). The type locality is Scott Mountain Summit in Trinity County, intersected by State Highway 3 and the Pacific Crest Trail (Ferlatte 1978). The type locality is the most collected single population represented in herbaria, due to the accessibility provided by the maintained highway and forest trails. However, while the type locality may appear accessible today, we speculate that the species was not collected prior to 1936 due to morphological similarity to *Hesperochiron californicus* (Benth.) S. Watson, which also occurs on Scott Mountain, and the limited presence of botanical collectors in the Scott Mountains prior to 1930.

For three decades Scott Mountain was the only known locality for the species, but currently seven populations have been vouchered in herbaria, although three are from single collections. The USDA National Forest Service Shasta-Trinity and Klamath have surveyed and continue to manage fifty populations for the species on public lands, with additional unvouchered reports of populations on private land holdings in the California Department of Fish and Game Natural Diversity Database (Adamson and Kierstead-Nelson 1991). The USDA Forest Service lists *Phacelia dalesiana* as a sensitive species, and the California Native Plant Society lists *Phacelia dalesiana* as 4.3 (limited distribution, not very threatened in California), California Endemic, S3.3 (vulnerable) and G3 (vulnerable, no current threats known) (CNPS 2010; Showalter 1991).

The elevation of the species ranges from 1600-2200 m, on generally flat topography in openings or dry meadows in upper montane coniferous forest (Adamson and Kierstead-Nelson 1991). All populations are on soils derived from ultrabasic rock associated with the Trinity Ultramafic sheet (Kruckeberg 1984; Adamson and Kierstead-Nelson 1991). *Howellanthus dalesianus* has been documented on disturbed areas, with variation in litter cover within mature populations, although the species requires bare soil for germination and establishment (Adamson and Kierstead-Nelson 1991; Kierstead-Nelson and Engstrom 1991-1993). The species blooms from May to August, with flowering closely tied to snowmelt for a short season, and fruits until late September.

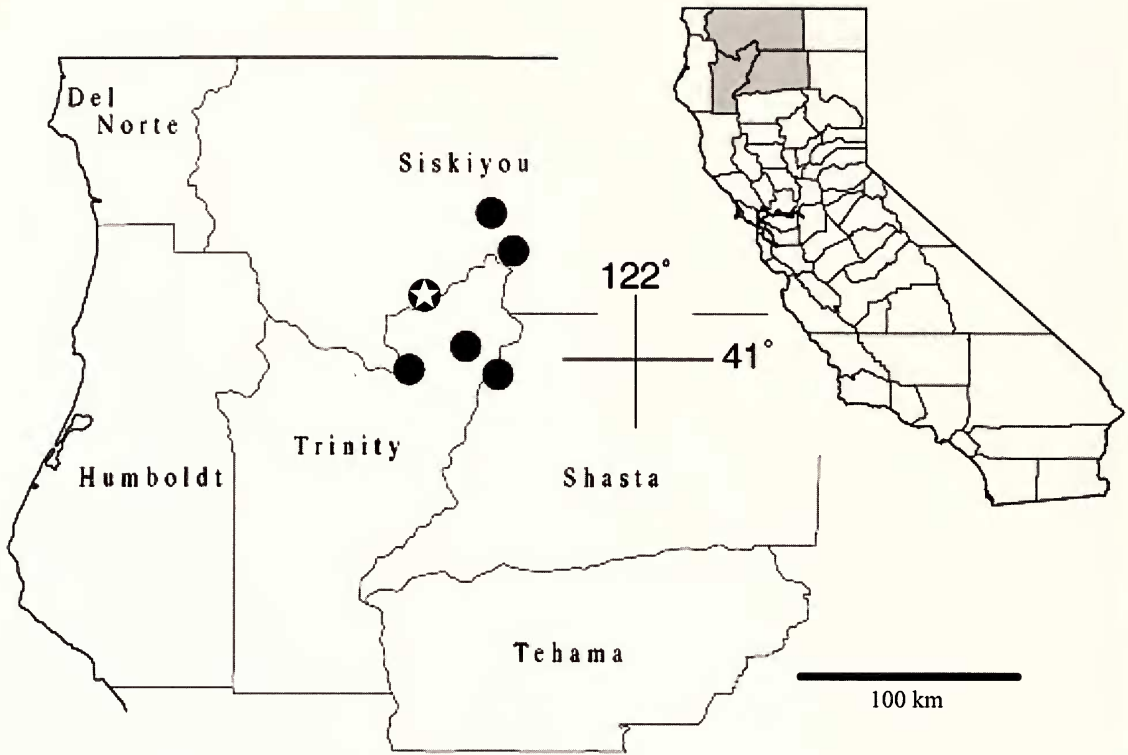


FIG. 5. Distribution of vouchered collections of *Howellanthus dalesianus* in Siskiyou, Trinity, and Shasta counties, California. Starred locality indicates type locality on map.

#### ADDITIONAL SPECIMENS EXAMINED

USA. CALIFORNIA. **Shasta Co.:** Trinity Mountains, saddle between Rattlesnake Hill and Chicken Hawk Hill, at summit on Forest Rd 38N21, at Sardine Spring, 15 June 1993, *D. W. Taylor* (JEPS). **Siskiyou Co.:** 4 m NE Scott Mountain, trail from Robbers Meadows to Kangaroo Lake, 1 June 1977, *S. Horner* 110 (JEPS); Mt. Shasta Ranger District, Mumbo Basin at 40N26 and 38N24, 20 June 1991, *J. Kierstead* 91-68 (ST); Scott Mountain divide, 17 May 1947, *H. L. Mason* 14773 (UC); Kangaroo Lake Campground, along streams, 25 July 1969, *F. W. Oettinger* s.n. (CAS, RSA, UC); Kangaroo Lake, 25 July 1967, *D. Parker* and *W. Roderick* s.n. (CAS); Scott Mountain Summit, 21 June 2005, *R. W. Patterson* & *S. Santos* 1982 (SFSU); Scott Mountain rd summit, upper end of N meadow, 14 June 1963, *W. Roderick* s.n. (JEPS); Scott Mountain campground, 18 June 2010, *G. K. Walden* 324 (SFSU); Scott Mountain campground, 7 July 2010, *G. K. Walden* 332 (SFSU). **Trinity Co.:** Summit of Scott Mountain, 21 May 1936, *E. D. Cantelow* 1276 (CAS); Summit of Scott Mountain, 9 June 1939, *E. D. Cantelow* 2891 (CAS); Summit of Scott Mountain, 23 June 1948, *E. D. Cantelow* s.n. (CAS); Near Scott Mountain Summit, close to the town of Callahan,

China Mountain quadrangle 1 July 1978, *Clifton and Ground* 1662 (UC); Summit of rd over Scott Mountain, sandy flat of rocky meadow, 1 June 1946, *L. Constance* and *R. H. Shan* 3070 (CAS, UC); Trail from Deer Flat to Shiny Lake ca. 1/4 m above Deer Creek Flat, 8 July 1976, *J. DiTomaso* 600 (UC); Along USFS trail 8W13 from Deer Flat to Shimmy Lake, 1/4 to 1/2 m E of Deer Flat Camp, 7 July 1976, *W. J. Ferlatte* and *J. DiTomaso* 1776 (CAS, JEPS); Summit of Scott Mountain, N of Carrville, 24 August 1936, *J. T. Howell* 12736 (CAS); Summit of Scott Mountain, N of Carrville, 30 July 1937, *J. T. Howell* 13691 (CAS); Scott Mountain summit on rd from Carrville to Callahan, 20 May 1980, *J. T. Howell*, *T. C. Fuller* and *G. D. Barbe* 53545 (CAS); Summit of Scott Mountain, rocky serpentine soil, 9 June 1958, *D. Parker* 649 (CAS, RSA); Scorpion Lake, Trinity Mountains, westerly upper flank Bonanza King, 13 June 2002, *D. W. Taylor* 18156 (JEPS). **Shasta Co.:** Trinity Mountains, saddle between Rattlesnake Hill and Chicken Hawk Hill, at summit on Forest Rd 38N21, at Sardine Spring, 15 June 1993, *D. W. Taylor* 13656 (JEPS).

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